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An Exploratory Look at Graduate Students' Learning Strategies in Asynchronous Online Courses

Cassandra Williams
Louisiana State University-Shreveport, Shreveport, LA USA

Kristi Young
Louisiana State University-Shreveport, Shreveport, LA USA

Dionne Williams
Louisiana State University-Shreveport, Shreveport, LA USA

Joyce Farrow
Louisiana State University-Shreveport, Shreveport, LA USA

Melissa J. Hawthorne
Louisiana State University-Shreveport, Shreveport, LA USA

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ABSTRACT: It is important that all students have a strong set of study strategies. This is especially true for graduate students in Education. These students frequently are, or are planning to be, administrators who. Principals are in a unique position to introduce study strategies to the teachers working under them. This, in turn, gives teachers a set of tools that they can pass on to their students. However, most students rely on strategies, such as rereading, that research shows to be less effective. Research has also identified numerous strategies that are advantageous for retaining studied information (e.g., Carpenter et al.; 2022). However, to put the strategies to use, teachers must know that they exist and when to use them. The current study examined how frequently graduate students in asynchronous online graduate courses use empirically validated research strategies. Specifically, the study focused on retrieval practice, elaboration, dual coding and interleaving. The results showed that the use of such strategies varies among students with interleaving being the most frequently used strategy and dual coding being the least used strategy.

KEYWORDS: study strategies, retrieval practice, elaboration, dual coding, interleaving

INTRODUCTION

Graduate students are often assumed to possess advanced study skills, yet research indicates that many enter their programs without a strong foundation in effective learning strategies (Onwuegbuzie et al., 2001; Shin et al., 2010). While graduate students identified appropriate study skills more often than undergraduates, they may not use those strategies when studying. Strategies such as retrieval practice, dual coding, elaboration, and interleaving are known to significantly enhance retention and comprehension (Carpenter et al., 2022; Dunlosky et al., 2013; Rosenshine, 2012); however, students must first be made aware of these methods and understand how to apply them effectively.

Onweugbusie, Slate, and Schwartz (2001) found that graduate students often read study materials in a passive manner, which reduces the amount of learning. The authors showed time management, note taking and other study skills are prevalent study strategies among graduate students. However, Onweugbusi et al., focused on items such as motivation, and note taking and had only three questions relating to specific study techniques. Similarly, Fouche (2017) found a strong positive correlation between academic achievement and study strategies such as doing homework, participating in class, and managing their time well. Although there is abundant literature on study habits among undergraduate students, there is very little literature on graduate students. What literature that does exist tends to focus on issues such as time management and class participation (Crede & Kuneel, 2008).

Teaching study strategies to graduate students enhance their metacognitive skills, enabling them to plan, monitor, and evaluate their learning. The process also empowers them to identify knowledge gaps and advocate support when needed (Goedhart, 2021; Singer & Mogensen, 2021). Graduate students in education programs are uniquely positioned to influence instructional practices and advocate evidence-based learning strategies within schools and districts. Knowledge about empirically supported study habits is particularly important in graduate education, where learners are expected to assume leadership roles and model best practices for their peers.

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Furthermore, graduate students in Master of Education degree (MED) programs frequently go on to assume leadership roles in schools where they can influence K-12 teachers. This can start a cascade where principals and other leaders pass on information regarding study skills to teachers. In turn, teachers can teach and model these strategies for students, thereby equipping them to be better learners. Unfortunately, research shows that both students and instructors often hold misconceptions about effective study methods and may rely on less effective techniques such as rereading or highlighting (Morehead et al., 2016). Without targeted interventions to increase awareness and application of research-based strategies, graduate students may be ill-prepared to champion these approaches in their future leadership roles.

The current study seeks to explore the frequency with which graduate students in asynchronous online master's in education (MED) courses employ key evidence-based study strategies (i.e. dual coding, retrieval practice, elaboration, and interleaving). By understanding current practices and gaps, educators can better support graduate students in becoming confident learners and effective advocates for improved teaching and learning.

LITERATURE REVIEW

Importance of study skills

Study skills are an important part of higher education that has prompted a significant level of research. **(**Fong et al., 2016; Hassanbeigi et al, 2011; McCain et al., 2018**).** Knowing how to study allows for faster acquisition of knowledge and retention that lasts for years (Dunlosky et al., 2013). Typically, universities expect students to come into higher education with well-developed study skills. Unfortunately, that is often not the case (McGinley, Carlson, & Hoppe, 2008**).** Skills that saw students through high school are frequently insufficient at the college level where the course work is more demanding. For example, students often confuse the amount of time they spend studying to their level of content mastery (Brown et al., 2014). They also tend to fall back on study strategies such as cramming because they believe it will help them with long-term retention of the material (Bjork et al., 2013). Unfortunately, such strategies hinder students' learning and performance (Gurung, 2005; Morehead et al., 2016).

Research shows that there is no single set of study habits that lead to academic success (Gentry, 2012; Lei, 2015). For example, Fazal et al. (2012) found that students who used a variety of study skills reported greater academic success, whereas Hawthorne et al. (2021) showed that avoiding bad study habits is also important for student success. However, research identified certain study skills that are repeatedly associated with positive student outcomes. For this study, the focus was on interleaving, retrieval practice, dual coding, and elaboration.

Interleaving

Interleaving is a study strategy that involves the mixing of different subjects or topics in the same study session instead of focusing on one topic at a time. This approach helps to improve problem-solving skills, long-term retention, and the ability to generalize newly learned information. In the seminal study by Kornell and Bjork (2008), participants studied artwork in either interleaved or block formats. The results demonstrated that interleaving was superior to blocking as a study strategy. This finding has been replicated multiple times and extended to other domains such as the learning of science concepts (e.g. Rawson, Thomas, & Jacoby, 2015; Eglington & Kang, 2017).

Interleaving, though challenging at first, promotes long-term learning outcomes. For example, Rohrer, Dedrick, and Burgess (2014) found that interleaving not only improved performance for math, but the effect also extended to other content. Similarly, Brunmair and Richter (2019) found that interleaving increased test performance by almost half a standard deviation. Furthermore, interleaving enhances memory capacity, as well as long-term memory, by promoting the use of discrimination. Using interleaving to practice different topics enhances learners' ability to recognize and remember distinguishing characteristics of each topic. In turn, this strengthens memory connections and improves long-term memory retention

Retrieval practice

Retrieval practice is a learning technique that involves recalling studied material without seeing it in front of you. It is particularly effective because retrieval requires the use of memory, which is one of the most basic aspects of learning (Hadwin, 2022). Retrieval practice also lets students measure what they do and do not know. Whenever material seems obvious and easy to retrieve, students tend to suffer from illusions of knowing (Brown, et al., 2014). Using retrieval practice coupled with corrective feedback shatters the illusion and builds student knowledge.

Furthermore, research demonstrates that retrieval practice is more productive than common strategies such as highlighting concepts and concept mapping (McDermott, 2021; Karpicke & Blunt, 2011; Roediger & Karpicke, 2006). Classroom research shows that retrieval practice is robust across age groups, individual differences in working memory, and different topics of study (Fordyce, et al., 2025; McDermott, 2021). It also improves higher order thinking and results in better performance on complex tasks and enhances metacognition (Agarwal & Bain, 2019).

Dual coding

Dual coding combines visual and verbal information to enhance learning and memory retention. By presenting concepts through both words and images, students can process information more effectively, making it easier to understand and recall later. Dual coding draws on Baddley's (1982) model of working memory, which holds that memory is processed through a phonological loop, dependent on auditory input, and a visuospatial sketchpad that draws on visual material. By pairing a visual representation with an auditory one, students provide multiple cues that can help with retrieval of pertinent information.

Dual coding involves three principles deriving from Paivio's (1990) work. First, using multimodal or multimedia provides better memory than either pictures or words alone (Kirschner & Hendrick, 2020). In addition, dual coding uses built in redundancy to strengthen memory. Finally, having the presentation of both modalities occur close in time and/or space results in better linkage between the modalities, thereby allowing easier access to the representations. For example, Feiyue (2022) found that using dual coding improved learning over either reading or writing alone. Similarly, Dong et al. (2022) showed that presenting videos of artwork frame-by-frame along with a text description of the artwork showed improved learning significantly over showing artwork followed by matching descriptions. Although dual coding is often presented as part of a larger theory of learning, it can be used effectively as an independent learning strategy.

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Elaboration

Elaboration strategies can be both learner-generated and instructor-supported. Learner-generated elaborations, such as self-explanation or the creation of personal examples, tend to yield the strongest learning outcomes because they require students to reorganize and reconstruct knowledge in personally meaningful ways (Malamed, 2021). Instructional elaborations, such as analogies or reflection questions, can also be beneficial, especially when students are first introduced to complex material. However, research consistently highlights the value of prompting students to generate their own connections and explanations (Fiorella & Mayer, 2016).

Recent studies have explored the impact of prompting elaboration during learning activities. While not all students spontaneously use elaboration strategies, those who do—even when prompted—demonstrate improved knowledge and test performance (Ruffin et al., 2024). This suggests that explicit encouragement to elaborate can help students adopt more effective study habits, particularly when guided to reflect on how new information relates to their existing knowledge (Academic Affairs, n.d.).

In summary, learning strategies are key to student success in higher education. Although there are numerous techniques, not all are supported by empirical research. Given that graduate students are already successful in the realm of education, it is expected that they already have developed a set of validated skills. Towards that end, the current study examines graduate students' use of retrieval practice, dual coding, elaboration, and interleaving.

METHOD

Participants

After obtaining IRB approval, a convenience sample was recruited from graduate students enrolled in the 100% online asynchronous MED programs at a small regional university. The group of 62 participants consisted of 7 males and 43 females; 12 participants did not reply. The group also consisted of 14 African American participants, 42 Caucasian participants, and 6 participants identified as Other. The average age was 33.31 years, ranging from 21-47 years. A power analysis indicated that 60 participants were required for 80% optimum power.

Materials

Participants completed a questionnaire developed by the authors to measure how frequently they used four specific study strategies. The questionnaire consisted of 20 Likert-style sentences describing real-life applications of the four strategies. Participants indicated how often they engaged in each behavior on a scale of 1-10 with 1 being "Never" and 10 being "Always." Participants also completed a demographic questionnaire. *Cronbach's* α = .980, indicating that the instrument had good internal reliability. (Survey available by request)

Table 1: Example survey questions

I start planning early for exams.
I prefer to test myself over the material that I am learning rather than simply restudying the material.
When I study, I try to make connections between different ideas.
I try to make links between topics when I switch from one to another.
I study by explaining visual materials in my own words

Procedure

The study strategies survey was distributed through Qualtrics, an online survey platform. The materials were presented in the following order - Informed consent, learning strategies survey, and a demographic survey. Initially, a practice run of 20 undergraduate students was conducted to determine if adjustments were necessary. The survey was then distributed to graduate students within the Master of Educational Leadership and Master of Education-Curriculum and Instruction programs. The invitation to participate and the link to the study were posted on the graduate programs' Moodle home pages.

RESULTS

Data reduction

The authors first checked the internal reliability of the instrument. Cronbach's Alpha = .980. indicating that the instrument had good internal reliability. Next, the authors used the maximum likelihood analysis to determine the dimensionality of the questionnaire. We used three criteria in identifying the number of factors to rotate: the a-priory belief that the 20 questions drew from four factors, a scree plot, and the interpretation of the rotated results. The scree plot supported the a-priori belief that the questionnaire drew from four factors. Based on the scree plot, four factors were rotated using a Verimax rotation. Elaboration accounted for 22.23% of the item variance; Interleaving accounted for 20.23% of the variance; Dual Coding accounted for 19.68% of the variance; and Retrieval Practice accounted for 19.32% of the variance. (Data set available at https://doi.org/10.7910/DVN/5FJLN8.)

Within subjects ANOVA

Next, we used a one-way within subjects ANOVA to explore the data. The results indicated a significant effect of Study Strategy (SS), *Wilks'* Λ = .441, $F(3,51) = 21.54$. $p < .001$, multivariate $\eta^2 = .559$ indicating that there were significant differences in the frequency of use of the specific strategies. To further explore this, six pairwise comparisons, using a Bonferroni correction resulting in $p = .008$, revealed four significant results. Comparisons of Retrieval Practice and Elaboration were significant, $t = 2.52$, $p = .007$, *Cohen's d* = .325, indicating that Elaboration is used more often than Retrieval Practice. In addition, Interleaving was greater than Retrieval Practice, $t = 6.82$, $p < .001$, *Cohn's d* = .881. Furthermore, Elaboration was used more frequently than Dual Coding, $t = 3.18$, $p < .001$, *Cohn's d* =.425, and Interleaving was used more often than Dual Coding, $t = 6.83$, $p < .001$, *Cohn's d* = .956. (See Figure 1)

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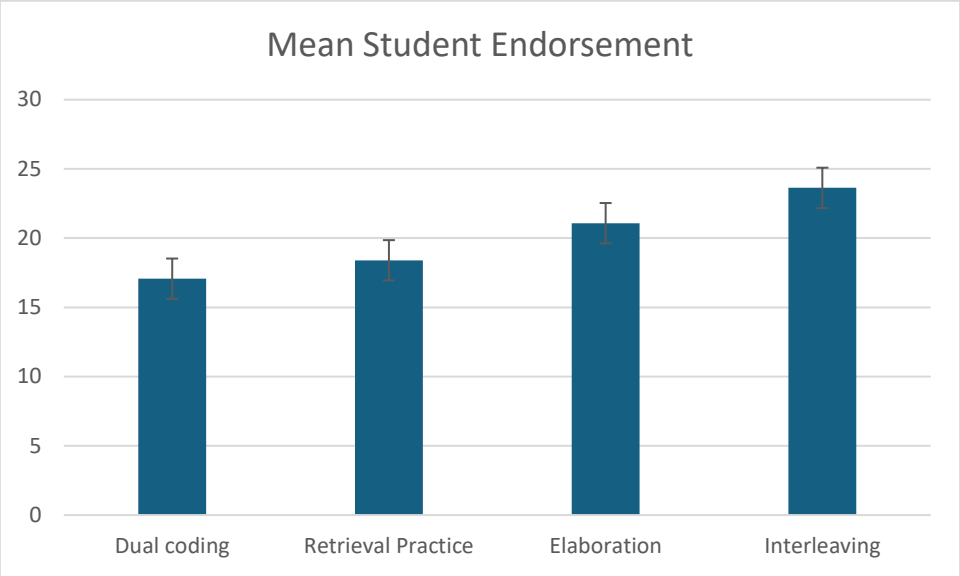


Figure 1. Frequency of endorsement of study strategies

Upon reviewing the trends throughout the data p, it was evident that the range of scores reported from prompt to prompt helps give a clearer picture of where students are lacking. For example, the survey prompt "*When I study, I try to make connections between different ideas"* was rated the highest overall with an average score of 8 out of 10. The students' use of flashcards tended to have the most dispersion or spread of responses from studying independently than when studying with a group. According to the students' responses, when students are in a group, flashcards are used much less often than when students study by themselves. Lastly, it appears that when sorted by GPA, students with higher GPAs tend to give more 10 out of 10 scores than students with lower GPAs, possibly indicating that these students have found study methods that work for them in the past and have chosen to stick with it.

DISCUSSION

This study examined how frequently graduate students utilize evidence-based study strategies such as dual coding, retrieval practice, elaboration, and interleaving. The findings indicated that both elaboration and interleaving were relied upon considerably more than retrieval practices and dual coding with interleaving showing the strongest influence.

Although graduate students are expected to have developed effective study habits, the results concerning the range of graduate-student endorsements of interleaving, retrieval practice, dual coding, and elaboration indicate that these techniques, when used, may not be consistently applied. This inconsistency might imply that most students approach higher education using habits that were formed along earlier parts of their academic journey, rather than using strategies grounded in best practices. It would follow from this that graduate coursework may also benefit from the incorporation of research-based learning strategies into regular instructional practices.

As Carpenter et. al. (2022) pointed out, learners are underutilizing effective study strategies, and Dunlosky et, al. (2013) noted that students often don't use good study strategies because they are not taught to use them. As present and/or future leaders in education, graduate students need to know what skills are effective as they will be in positions to influence students, teachers, and other administrators. By starting our research at the graduate level, we are better able to identify a starting place to teach key study strategies. If graduate students enter or are already in service as principals and administrators within school systems, they can act to enhance the knowledge of other administrators.

Also, the principals can directly influence teachers through methods such as professional development experiences. As k-12 teachers begin to incorporate study skills into their teaching, students will develop better study skills that they will take with them when they reach college. As those students move into teaching and/or continue into graduate school, the loop of study skills instruction becomes complete. (See Figure 2). The current study is based on the idea that graduate students function as catalysts for the dissemination of evidence-based learning strategies across educational systems. The circular structure reflects reciprocal and sustained influence among graduate students, principals and administrators, K–12 educators, and undergraduate students, with evidence-based learning strategies anchoring the model

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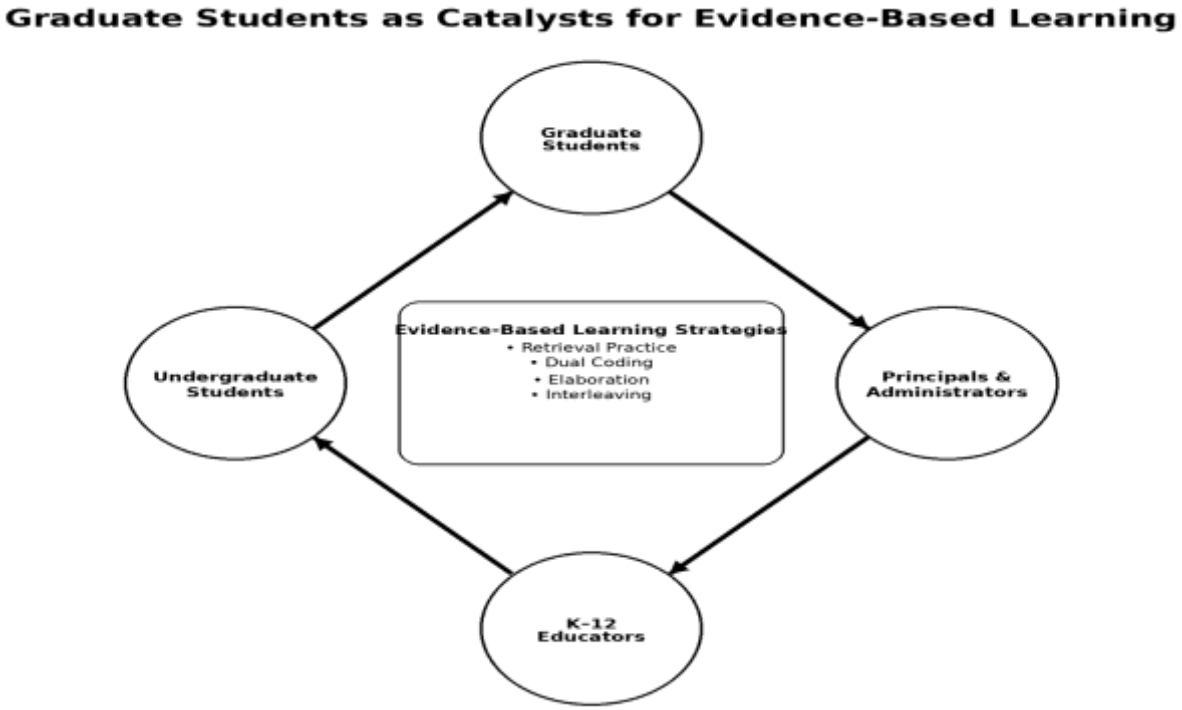


Figure 2: Model of evidence-based learning

Applications

One key to establishing the use of empirically supported study strategies is to teach graduate students using both written materials and by incorporating strategies into graduate courses. For example, Lang (2016) suggests using open questions during class to encourage students to recall recently taught information. This can also be done in the use of closing questions in which students are required to recall information covered in the class. Furthermore, the use of frequent low-stakes quizzes and reading checks can help both face-to-face students and online students use retrieval practice. Using brain dumps, where students are required to write down everything they know on a topic, is a way to incorporate retrieval practice into both online and face-to-face classes (Agarwal & Bain, 2025) The prompt can be narrow or widespread depending on the learning goals. Similarly, students can be asked to write down two things they learned from a lecture or the weekly reading assignments. For maximum effect, feedback should be included, whether by peer review or instructor feedback.

Similarly, Lang (2016) discusses some ways to bring interleaving into the classroom (both virtually and face-to-face). Interleaving involves alternating between subjects or switching between older materials and more recently studied information. One way to bring interleaving into the classroom is to write questions covering past and current topics on slips of paper. The slips are put into a bowl, then a student picks a slip. The class then discusses the answer to the question before going on to pick another slip of paper. This technique allows for random interleaving of multiple topics (Agarwal & Bain, 2025). Admittedly, introducing interleaving into asynchronous online classes is more of a challenge. One approach is to use educational technology to enhance interleaving. For example, students can use a flash card app, like Anki or Quizlet, to design decks of cards that contain interleaved topics and questions (Open Library, n.d.).

Elaboration can be integrated into the design of instruction by providing learners with opportunities to make meaningful connections between what they are learning and what they already know, what they have experienced, and what they do professionally (Malamad, 2021, Smith & Weinstein, 2025). Requiring students to explain the material in their own words is a basic way to introduce elaboration into the face-to-face and virtual classrooms. Elaboration is also present in discussion boards where students are asked by peers or by instructors to talk more about the assigned topics. Requiring students to compare and contrast concepts and the use of graphic organizers are simple ways to add elaboration to a study session.

Finally, dual coding is an effective but often overlooked study strategy. For example, Feiyue (2022) found that using dual coding improved learning over either reading or writing alone. Similarly, Dong et al. (2022) showed that presenting videos of artwork frame-by-frame along with a text description of the artwork shown improved learning significantly over showing artwork followed by matching descriptions. Teachers can incorporate dual coding into the courses by requiring students to draw visuals to match the content being taught. Similarly, students can be given visuals, and the students provide a written narrative to match the material. Students can also be challenged to come up with different ways to represent the information they are learning.

It would serve universities well to incorporate an assessment of graduate students' skills upon acceptance to the university. Once the university has a solid database of study strategies, they can identify where students need the most help. The next step will be finding a way to introduce students to the strategies and encourage them to use these techniques. Students can be required to complete a brief orientation session in which they are taught how to use the different strategies. A booklet describing different ways to include the strategies can be included as part of the orientation.

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Ensuring compliance is the tricky part. For universities who partner with agencies that supply academic coaches, the coaches can include questions about if the students are using the strategies, how often, and noticeable effects, in any. Universities that do not employee academic coaches could provide students with journals and ask them to document when they use a particular strategy. They could also document any differences in their academic performances. Follow-up analysis of the impact of learning and using study strategies on students' GPAs will guide administrators in determining best-practices in teaching study skills.

Limitations

The study had a relatively small sample size which limited the depth of analysis available. Also, the participants were all students in an asynchronous online MED program, which limits the generalizability of the findings.

Future research

The results of this study highlight the need to focus on direct instruction in metacognitive and evidence-based study strategies within graduate education programs. Although graduate students are often presumed to possess advanced learning skills, the observed variability in their use of strategies such as interleaving, retrieval practice, dual coding, and elaboration suggests that these skills are not yet universally internalized (Carpenter et al., 2022; Dunlosky et al., 2013). Embedding focused training on these techniques into graduate curricula could help students maximize their learning and prepare them to implement them in their leadership role (Goedhart, 2021; Singer & Mogensen, 2021).

Also, a study on the effect this instruction has on students' self-assurance as learners, the ability to self-assess their understanding, and the ability to adapt study strategies according to the increase in curriculum load would be highly beneficial. When graduate students comprehend the learning and studying processes better, they can effectively model and provide the most effective and beneficial study strategies to their pupils. Even though this line of study would take more years to surface, the value and effect it bears on the subject matter would be highly impactful.

CONCLUSION

The findings contribute to a greater understanding of the study skills preferred by graduate students in asynchronous online courses, highlighting a potential gap to correlate the preferred study strategy and its effectiveness. Key learnings from this research study may augment instructional delivery and educational resources to promote a balanced and strategic approach that complements how students study. In summary, this study emphasizes the impact of cultivating metacognitive skills and evidence-based study habits among students. By emphasizing these areas and their importance in future research, graduate programs can help shape successful learners proficient in educational advocacy and in implementing enhanced teaching and learning practices.

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Use of AI: No AI was used in the writing of this paper.

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Corresponding Author: Melissa J. Hawthorne

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